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CAPITAL EQUIPMENT ACQUISITION PROCEDURES
FOR ENHANCING PRODUCTIVITY AT PWC
SAN FRANCISCO

by

Douglas Arthur Wolfe

December 1985

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The purpose of this thesis is to detail the management control process as related to the Productivity Program at Navy Public Works (PWC) San Francisco, California. The Department of Defense (DOD) and Navy programs provide a broad framework within which all PWCs have developed their own unique Productivity Programs. The Asset Capitalization Program (ACP) has provided industrial fund activities like PWCs with the means of implementing the productivity strategy. In particular, the Capital Equipment Investment Plan establishes a systematic approach in the substitution of capital equipment for labor with enhanced productivity a desired result. With such a plan, PWC San Francisco has been able to achieve revitalization and modernization of capital assets.

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Capital Equipment Acquisition Procedures for Enhancing Productivity at PWC San Francisco

by

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Lieutenant, Civil Engineer Corps, United States Navy
B.C.E., Villanova University, 1980

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requirements for the degree of

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ABSTRACT

The purpose of this thesis is to detail the management control process as related to the Productivity Program at Navy Public Works Center (PWC) San Francisco, California. The Department of Defense (DOD) and Navy programs provide a broad framework within which all PWCs have developed their own unique Productivity Programs. The Asset Capitalization Program (ACP) has provided industrial fund activities like PWCs with the means of implementing the productivity strategy. In particular, the Capital Equipment Investment Plan establishes a systematic approach in the substitution of capital equipment for labor with enhanced productivity a desired result. With such a plan, PWC San Francisco has been able to achieve revitalization and modernization of capital assets. However, there are weaknesses in the planning and acquisition procedures which have been identified and which require management attention.

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I. INTRODUCTION

Productivity enhancement is characterized by an ongoing search for investment opportunities which lead to improved use of labor, capital, and natural resources. Technological change has, for the most part, provided the impetus for productivity growth in industry. In the Navy, however, there is a serious continuing problem of obsolescence. This problem is compounded by the considerable pressure created in the competition for limited financial resources. Not only are Navy organizations tasked with meeting basic mission requirements; they must also meet standards for personnel quality-of-life, safety, and the environment. Thus, the Navy must address the pressures placed on it by these standards, while addressing the need to improve productivity at the same time. The challenge to Navy management, then, is to establish a balanced relationship between productivity programs and other competing programs when planning and budgeting.

Within the Navy, the Systems Commands are responsible for reviewing long-range plans and mission assignments, and formulating a productivity investment strategy that is within their resource allocations. In the case of Public Works Centers (PWCs), Naval Facilities Engineering Command (NAVFACENGCOM) provides a general productivity strategy which addresses all aspects of industrial fund operations.

At the activity level, the PWC is permitted to translate this general strategy into a viable program specifically suited to its operation. Such a program should offer productivity gains in organizational functioning, personnel and staffing, and capital investments.

Like all Navy organizations, PWCs encounter investment opportunities throughout the course of operation. Mission assignments may change, requiring new equipment. Old machinery may become worn or obsolete and need replacement. Or, the activity might need to expand into areas where man and machine are overworked.

Numerous suggestions for using capital originate at all levels of the command. Considering the number of proposals competing for limited funds, there are more capital investment opportunities than can be accepted. Hence, there is a growing backlog of apparently worthy projects for consideration. Yet, there is a continued general decline in the condition and workability of existing capital assets [Ref. 1; encl. 5, p. 1]. Thus, the allocation of limited resources dictates that investment proposals cannot simply be selected in a haphazard manner. A viable productivity investment strategy must be characterized by an organized search for opportunities and clearly defined implementation procedures and performance measures. Furthermore, the investment strategy must emphasize productivity enhancement and result in improved organizational performance [Ref. 1:encl. 5, p.1].

Investments which do not contribute to this end should be rejected, and initiatives which enhance productivity should receive top priority.

The Department of Defense (DOD) has established a Productivity Enhancing Capital Investment (PECI) program to support such an investment strategy [Ref. 2:p. 25]. Funds are set aside in the annual DOD budget to be made available to requesting activities for a wide range of cost- and labor-saving investments. The main objective of this program is to implement improvements which make routine functions easier and more productive, thereby obtaining better returns on investments [Ref. 2:p. 21]. The primary intent is to improve the output-to-resource input relationship. A number of funding categories are a part of the PECI program. Collectively, the Productivity Enhancing Investment Fund (PEIF), the Productivity Investment Fund (PIF), and the component-sponsored investment fund constitute a comprehensive strategy for financing productivity improvement initiatives at all levels within the DOD [Ref. 2:p. 22].

Until FY83, industrial fund activities such as PWCs, participated in the PECI program in the same manner as did activities funded by appropriations. The Asset Capitalization Program (ACP) changed this process by allowing industrial fund activities to purchase equipment by using operating capital. The costs are then recovered by charging customers for work performed. Ideally, the ACP and PECI programs are

to complement each other and provide greater flexibility in financing productivity enhancing technologies. This thesis provides evidence that at least one industrial fund activity, PWC San Francisco, has relied exclusively on the ACP for productivity improvements.

The research presented is based on information collected as a result of a field visit to PWC San Francisco. Several interviews were conducted with financial and productivity management personnel. Copies of documentation and instructions were obtained for further analysis. The objective was to collect, assemble, and analyze data in an effort to outline and describe the procedures and methods used in the acquisition of capital equipment at PWC San Francisco. Specific emphasis was placed on equipment and programs which contributed to increased productivity. Relevant data concerning the relationship between PECI programs and the ACP was of particular interest.

The theoretical foundation for such an analysis is based on the organization's planning, execution, and evaluation of capital investment opportunities. Collectively, these elements form a management control system (MCS) which is uniquely defined by the activity. This thesis will describe the MCS of PWC San Francisco, and outline the productivity strategy concerning capital equipment. The purpose is to permit subsequent investigation into the existing Productivity Improvement Program's efficiency, and to elicit suggestions for improvement.

Chapter two focuses on the historical background and current guidance concerning the productivity programs within the DOD. The DOD program is examined first, and offers a broad overview of objectives and policies which relate to productivity. Personnel responsible for the program are identified, and their duties are summarized. The Department of the Navy (DON) Productivity Program is also described with references to general initiatives concerning productivity and key personnel responsible for implementing these initiatives. Next, the NAVFACENGCOM Productivity Enhancement Program is detailed. The preparation and development of the command's most important document concerning the annual Productivity Improvement Plan is outlined. Finally, the productivity programs and initiatives at the activity level are examined.

Chapter three offers an in-depth look at Navy Industrial Fund (NIF) operations. As NIF activities, PWCs are concerned with establishing stabilized rates which are consistent with services provided. Furthermore, the stabilized rates are a significant factor in the Capital Equipment Investment Program at PWCs. For this reason, it is necessary for the reader to have a clear understanding of both the general operation of industrial fund activities, and specific PWC operations.

Chapter four takes a closer look at the NAVFACENGCOM Productivity Improvement Plan. The basic elements of this plan are noted and described. Human resource development

and productivity measurements are briefly discussed. Capital investments, which are related to two important productivity programs, the ACP and the PECI Program, are discussed in more detail. The chapter concludes with a description of the field activities' input to the NAVFACENGCOM Productivity Improvement Plan and a description of the responsibilities of a key individual--the Command Productivity Principal.

Chapter five begins with a brief historical background of the ACP. The program's three basic elements--management information systems, minor construction, and capital equipment investments--are explained in some detail. As a part of the ACP, the budgeting for capital equipment through the Five-Year Capital Equipment Investment Plan at PWC San Francisco is thoroughly examined. The most important aspects of time schedules and submission requirements are discussed.

Chapter six goes into greater detail as far as PWC San Francisco evaluation criteria and prioritization methods used in composing capital equipment buy lists. The chapter also outlines the schedule for the development and subsequent incorporation of this list into the Five-Year Capital Equipment Investment Plan. The final section describes NAVFACENGCOM's requirements for an economic analysis of capital equipment acquisitions.

Chapter seven provides an overall assessment of the capital equipment investment program at PWC San Francisco in regard to the management control process. Several

recommendations and comments are also made concerning the ACP. The ACP and PECI Programs' effect on productivity improvement at the activity level is evaluated. Lastly, a broader perspective on productivity enhancement is offered which should ideally complement whatever program may be implemented.

The information contained herein is a preliminary analysis of program performance at a specific activity. Beginning with a productivity overview, and culminating with the contributions and procedures for acquisitions of just one element (capital equipment), this report provides a cursory look at one PWC's solution to the problem of meeting increasing demands with a decreasing budget. Innovative programs supported by dedicated managers will enhance productivity. The Capital Equipment Investment Program appears to have satisfied at least part of this effort at PWC San Francisco.

II. PRODUCTIVITY INITIATIVES

A. DEPARTMENT OF DEFENSE PRODUCTIVITY PROGRAM

The primary objective of the DOD Productivity Program is to enhance growth in productivity (i.e., increase the amount of goods produced or services rendered in relation to the amount of resources expended) [Ref. 3:p. 1]. The program encompasses all facets of productivity including enhancement, measurement, and evaluation. Implementation of such a plan depends on identifying strengths and weaknesses in the efficiency and effectiveness of a specific organization. The DOD recognizes that an efficient organization uses all types of resources to accomplish a given mission. The idea of total resource application in an effort to enhance productivity places particular emphasis on labor. Therefore, the DOD views productivity improvements as an offset to continued increases in labor costs. The consequences of such a program are the freeing of funds for other vital needs and benefits to customer agencies in the form of lower costs.

The DOD Productivity Program provides a comprehensive guide to planning, implementing, and evaluating productivity within the DOD. The initial step in the development of the program is the establishment of productivity goals. These goals must be consistent with the Planning and Programming guidance issued by the Office of the Secretary of Defense (OSD) [Ref. 3:p. 2]. Such goals are subdivided by major command and operating agencies prior to the beginning of each fiscal year.

Subsequently, each DOD component is expected to implement a productivity program which provides a continuous search for ways to improve operations. Currently, the DOD has placed the most emphasis on the efficiency of labor [Ref. 3:p. 1]. Still, a comprehensive program encourages the use of all available means of increasing productivity. Four basic means are through (1) methods and standards improvements, (2) capital investments, (3) training, and (4) motivation [Ref. 3:p. 2]. The DOD program also includes techniques for ongoing analysis and evaluation of productivity improvements. The program is currently seeking ways through research and studies to improve motivation within a work force, with productivity improvement a desired outcome. Responsibility for ensuring such policies are carried out belongs to the Under Secretaries and Assistant Secretaries of Defense, the Secretaries of the Military Departments, the Chairman of the Joint Chiefs of Staff, and the Directors of Defense Agencies. They are to ensure all aspects of productivity are included as an integral part of the planning, programming, and budgeting system (PPBS).

The DOD Productivity Program is labor-oriented; therefore, the DOD has designated labor productivity as the primary basis for evaluating productivity as a whole [Ref. 4:p. 2]. With such a basis established, productivity improvement within an organization is directed primarily at labor cost savings. The savings realized under the Productivity Program result in a lower unit cost of operation. Internal

reinvestment of these savings also establishes a management productivity incentive. The program further dictates that any labor or manpower decisions consider productivity impacts. The intent of this is to minimize adverse effects on productivity improvements previously achieved.

Overall responsibility for the DOD Productivity Program has been assigned to the Assistant Secretary of Defense, Acquisition and Logistics (ASD/A&L). His duties include specific policy guidance and program implementation through the issuance of DOD instructions. He also designates the DOD Productivity Principal who represents the DOD in all productivity matters, and is the central program manager.

The Assistant Secretary of Defense, Comptroller, issues policy guidance on productivity initiatives as a part of annual budget estimates and the Five-Year Defense Plan (FYDP). A fundamental element to the use of productivity data is the proper accounting for, and accumulation of, such information for which the Comptroller has responsibility. Policy guidance on economic analysis is also considered a part of his assigned duties.

To meet DOD objectives, each Secretary of a Military Department, and Director of a Defense Agency, is directed to establish their own Productivity Program within the guidelines promulgated by the DOD. They also must designate a Productivity Principal who has similar duties to the DOD Productivity Principal. Management should remain aware of the program,

and resource allocations should be made with regard to the activity budgets, manpower assignments, and training schedules.

B. DEPARTMENT OF THE NAVY PRODUCTIVITY PROGRAM

The intent of the Navy Productivity Improvement Program is to complement and fully integrate initiatives set forth in the DOD productivity program. Toward this end, the Secretary of the Navy (SECNAV) has assigned to the Assistant Secretary of the Navy, Shipbuilding and Logistics (ASN/S&L) the responsibility for ensuring implementation of stated productivity improvement objectives and policies. The program's primary objectives emphasize the growing attention productivity demands of managers within the DON. It stresses management accountability for limited resources, which require a basic reexamination of organizational missions, the development of legitimate output measurements, and the need for efficiencies in operations. Specifically, the Navy's program is intended to create an environment which fosters an economically sound productivity enhancing capital investment program, and a well-defined supporting organization. The Navy's total involvement also recognizes the importance of the military and civilian work force in establishing productivity incentives which enhance performance, and ultimately become an inherent organizational value. Finally, the DON sees the need for better utilization of productivity data in program budget and performance evaluation. [Ref. 5:p. 3]

These broad program objectives are expected to be carried out by all DON managers. These objectives are further defined by the fact that programs which improve productivity and/or enhance cost effectiveness are to become an identifiable part of performance appraisals, personnel assignments, capital investment planning, and management goals and objectives. A significant first step in developing a Productivity Program is the need for managers to develop and define organizational output. The output measurement is expected to reflect the basic mission of the organization and the support it provides in improving readiness/preparedness. The Navy considers rational judgment necessary in formulating such criteria, since these measures will be incorporated in evaluating performance and productivity as a part of various management and budget reviews.

Tangible managerial incentives are realized since all savings produced by the productivity-improving initiatives are held within an organization for discretionary application. The program also provides for rewarding improved productivity, both competitively between activities and within the activity itself. Improved organizational productivity will be recognized through economies and efficiencies in operations, and the elimination of waste. [Ref. 5:p.3]

Specific guidance assigned to the ASN/S&L includes properly addressing productivity issues in the DON Program and Planning Guidance (DNPPG), providing the Secretary of

Defense with DON productivity improvement goals and the designation of the DON Productivity Program Principal [Ref. 5:p. 4]. This position offers central program management for all productivity capital investment programs. Further concern is also emphasized by the Under Secretary of the Navy in the area of program evaluation and productivity trends. The ASN/S&L monitors this information, and subsequently provides guidance on data and manpower utilization. Consistent guidance thereby demands uniformity in evaluation, and the added responsibility of interpretation [Ref. 5:p. 4].

The Assistant Secretary of the Navy, Financial Management (ASN/FM) is tasked with incorporating all elements of the productivity program in the budget process and resource management areas. His responsibilities include guidance on economic analysis and program evaluation, and budget requirements for funding of productivity enhancing capital investments. He must ensure that productivity data are properly documented, and that legitimate savings are recognized through the appropriate accounting process. Such information is intended to assist management in capital investment decisions, and the allocation of resources in the Five-Year Defense Plan [Ref. 5:p. 5].

The Secretary of the Navy, Research, Engineering, and Systems (ASN/RE&S) is required to encourage technological advancements, and to program development in those areas which would enhance productivity, or result in operational

savings. The ASN/RE&S's technical advice is considered in method and process improvements, and in capital equipment acquisitions. [Ref. 5:p. 5]

Under the Chief of Naval Operations (CNO), the program is to be developed and implemented at subordinate levels [Ref. 5:p. 5]. Specific guidance is given to support the SECNAV objectives. Many of the productivity guidelines promulgated by higher levels, are further delineated (i.e., productivity measurement, productivity data utilization, and management decision support). Attention is focused on establishing and maintaining accountability for the Productivity Improvement Program at the senior management level. Meaningful efforts directed at encouraging maximum awareness of the PECI program are strongly promoted and endorsed. [Ref. 5:p. 6] Such initiatives require the CNO to plan and budget for program development. To achieve expected results, the plans and goals of subordinate commands must be reviewed, and subsequent implementation monitored, while productivity data are correlated [Ref. 5:p. 6].

Collectively and individually, all DON managers are responsible for promoting productivity enhancement, promulgating supporting guidelines, expanding productivity measurement to cover all functions, identifying valid output indicators, and ensuring preparation of legitimate analyses. The ultimate program to be implemented is expected to address those key productivity elements which have the greatest

organizational impact: capital investment, quality of work life, organization and management, process design, work engineering, and performance measurement [Ref. 5:p. 6].

C. NAVAL FACILITIES ENGINEERING COMMAND PRODUCTIVITY PROGRAM

Since the elimination of the Naval Material (NAVMAT) Command, the system commands, as echelon two commands, have assumed responsibility for planning, implementing, and administering productivity investment programs within their respective commands. As a systems command, the NAVFACENGCOM has formalized a Productivity Enhancement Program; the purpose is to bring attention to, and implement procedures necessary for, maximizing the use of limited resources. This is of special concern because of the numerous subordinate commands involved in industrial and service-oriented activities. PWCs are field activities within NAVFACENGCOM involved in providing services to agencies and activities. Therefore, productivity enhancement is of particular interest.

In the past, NAVFACENGCOM considered many of its productivity enhancing programs an integral part of its Command Management Plan (CMP). The CMP established specific objectives and provided funding levels and implementation procedures for carrying out management priorities that were of concern to the entire command. Recent interest in productivity enhancing programs has required a segregation of productivity initiatives. The result has been the establishment of the Productivity Enhancement Program. The program policy statement calls on

all personnel within NAVFACENGCOM to identify and develop productivity issues, eliminate productivity impediments and disincentives, implement productivity initiatives, and recognize individuals and organizations achieving productivity improvements [Ref. 6:p. 2]. The central element in this program is the development of the Command Productivity Improvement Plan [Ref. 6:p. 2].

This plan has as its foundation, input from all levels of NAVFACENGCOM which considers common issues pertaining to productivity enhancement. These items are referred to as productivity target issues, and are generally industrial or service functions, processes, or systems for which the output to input ratio can be improved [Ref. 6:p. 2]. The issues are called for on an annual basis. Once received at the command level, a Productivity Steering Committee, chaired by the Assistant Commander for Public Works Centers (FAC-15), reviews the target issues, selects those issues which are of concern to the entire NAVFACENGCOM organization, and incorporates these into the development of the Productivity Improvement Plan. The completed plan is forwarded to the Commander, NAVFACENGCOM and the Command Advisory Board for final approval. The Command Advisory Board directs the development and final disposition of all target issues. Individual target issues are addressed by task force teams, in-house experts, or leading field activities who call for further study or appropriate actions for implementation.

The Command Productivity Steering Committee is responsible for oversight of the Productivity Enhancement Program. In this capacity, members are given the authority to advise, evaluate, and formulate the policy pertaining to the program. The Committee is also tasked with ensuring that productivity issues are included as agenda items in workshops and seminars. Lastly, the Committee is expected to prepare the annual Productivity Improvement Plan so that it is in concert with the CMP.

D. ACTIVITY PRODUCTIVITY PROGRAM

Productivity enhancing programs at the activity level are based on implementation of instructions promulgated by higher authority. PWCs receive such guidance from NAVFACENGCOM. The direction provided is general in nature, and requires establishment of appropriate productivity improvement initiatives by the commanding officer. Program responsibilities demand only that employees be made aware of, and be given the opportunity to contribute to, productivity enhancement. A Navy instruction states that such work force involvement is a better utilization of available labor resources [Ref. 6:p. 3].

The only requirement imposed is that the activity must respond to requests for identification, development, and implementation of productivity target issues in connection with the NAVFACENGCOM Productivity Improvement Plan [Ref. 6:p. 3]. The target issues are broad in scope, encompassing all areas of productivity enhancement which allows PWCs latitude in

developing their own productivity issues. The issues considered appropriate for submission include: productivity initiatives, investment opportunities, procedural and method improvements, training, management goals and objectives, productivity measurement, and individual recognition [Ref. 6:p. 2].

PWC San Francisco has no command productivity improvement plan, and fulfills only those requirements levied by NAVFACENGCOM instructions. The designation of a command program representative has not been formalized, and there are no activity instructions which outline submission procedures for target issues, or general program guidance. As a collateral duty, an industrial engineer in the Engineering Department has assumed responsibility for coordinating and drafting the Command's reply to NAVFACENGCOM's annual call for productivity target issues. He provides limited advice to department heads in the development of these issues. Productivity measurements are formulated and compiled by the Management Department, with the specific guidance promulgated by NAVFACENGCOM. Quarterly performance indices for each PWC are distributed by message from NAVFACENGCOM. In general, PWC San Francisco responds to NAVFACENGCOM direction, but maintains no active Productivity Improvement Program.

III. THE ORGANIZATIONAL FRAMEWORK FOR PRODUCTIVITY IMPROVEMENT

A. INTRODUCTION

The Navy Industrial Fund (NIF) activities provide a variety of manufacture, repair, and support services to both tenant and local commands. The NIF method of operation requires resources to be expended in order to achieve a desired output specified by the customer. The resources to be expended must be budgeted and the output measured to ensure a given level of efficiency and customer satisfaction. As the availability of funding for these services comes under pressure from higher authority and more urgent priorities, NIF activities are searching for ways to improve the existing use of resources.

Capital investment is one particular resource which a NIF activity can control and allocate. As NIF activities, PWCs are looking to improve productivity through selective investment in capital opportunities. Toward this end, the generation of funds to meet expenses is of primary importance in the functioning of the activity. Hence, PWC productivity is dependent upon the efficiency of the organization's internal operation. If productivity is to be improved at PWCs, it must come from within the activity.

An explanation of NIF operations will serve as a useful foundation for understanding the PWC organization. Such an

understanding will facilitate the identification of capital investment procedures, and acquisition processes for possible improvement.

B. NAVY INDUSTRIAL FUND OPERATIONS

NIF activities are able to commence operations with an initial funding from Congress. This initial capitalization is called a "corpus." The corpus permits expenditures of funds for materials and labor, when orders for work are received from customers. Once the work is performed, the customer is billed, and the activity receives reimbursement. Reimbursement rates are set in an attempt to return the corpus to its original funding level.

NIF activities are run on a nonprofit basis. Reimbursements provided by customers are, in theory, supposed to cover only direct costs and indirect costs incurred by the activity, with no margin for profit. These reimbursements, through stabilized rates, must both accommodate this objective and reflect operational efficiency. Efficient NIF operation is of interest to Navy managers, since the less efficient the NIF activity, the higher the charge for services. Furthermore, planned productivity investments directly affect the NIF's stabilized rates by way of reduced direct labor and overhead costs, but increased capital costs.

The Navy operates 51 activities under the NIF. For reporting and budgeting purposes, these commands are organized into 14 seperate activity group sections. Organizational

control and responsibility for these activities is assigned to Activity Group commanders who are usually major claimants or systems commands. Overall NIF management is provided by the Comptroller of the Navy (NAVCOMPT). Eight PWCs form one of these activity groups which come under the control of the Naval Facilities (NAVFAC) Command. In FY 84, the PWC group had $967 million budgeted for customer orders from a total of $13.5 billion for all NIF activities [Ref. 7:p. H-6].

Budgeting under NIF is initiated by the Office of Management and Budget (OMB) Circular A-11. Each NIF activity provides their own individual input to the NIF A-11 budget, and transmits these budgets directly to NAVCOMPT. The total NIF budget is then submitted to DOD/OMB.

The major operating assets of the NIF are cash and the work-in-process account. The major liabilities are accounts payable, and accrued expenses (e.g., wages owed, leave due). The owner's equity section of the balance sheet consists of four main accounts: cash allocation, accumulated operating results, net asset capitalization, and equity reserves [Ref. 7:p.H-8].

An increase in the corpus of a NIF through direct appropriation is called a cash allocation. This direct influx of cash may be necessary due to a significant and unexpected expansion of NIF business, or more likely, it may compensate for pay raises and escalating costs. This funding is provided to the NIF activity rather than initiating a change in stabilized rates.

The accumulated operating results account records the net profit or loss of the NIF since its initial capitalization. Since the NIF has a no-profit objective, this account plays a major role in stabilized rate changes. The rate changes are subsequently determined by whether the account has a surplus or a deficit. The resulting cash flow will affect the accumulated operating results account by ultimately bringing it to a zero balance.

In FY 82, the equity reserves account was added to the balance sheet. This was done in anticipation of the impending change which would allow NIF activities to procure their own fixed assets with NIF resources, beginning in FY83 [Ref. 7:p. H-9]. The action gave NIF activities a cash objective in their rates. In other words, any budgeted increase or decrease in this account was permitted to be reflected in subsequent rates, thereby increasing or decreasing the cash balance. This account would then allow the NIFs to make budgeted capital investments. The Capital Investment Program, under the Asset Capitalization Program, is based upon the fact that as capital investments (capital equipment, minor construction, management systems) are acquired, they are capitalized and their depreciation becomes part of the stabilized rates for which the activity recovers these costs by charging customers for work performed. This sustains a cash balance sufficient to procure those capital investments necessary for NIF modernization. The Capital Investment

Program for PWCs in FY84 budgeted $19 million in obligational requirements, with $11.6 million in first-year expenditures [Ref. 7:p. H-23].

The net capitalization account is the owner's equity offset for the value of fixed assets which were capitalized beginning in FY82 [Ref. 7:p. H-9]. The book value of existing capital equipment was, in effect, removed from owner's equity and placed under the assets account in the balance sheet to be depreciated. The remaining value would be recovered through the stabilized rate charges to customer activities.

The income statement employed in the NIF has three main sections: revenue, costs, and operating results. Revenue is collected from the customer upon final billing for work performed by the NIF activity. Costs consist of production costs (direct labor and material, production overhead), and general and administrative overhead. Net operating results are derived from the sum of revenues less costs. The annual net operating result (surplus or deficit) is added to the accumulated operating results account in the balance sheet.

There are a number of different methods available to NIFs in charging customers for work accomplished. All have the expectation of recovering costs incurred for work, or service provided the customer. PWC San Francisco uses predetermined rates in the form of stabilized rates. The predetermined rates charged to the customer for services

rendered are based on an hourly, daily, or monthly rates. The importance of the predetermined rate to the NIF activity is that it is intended to return/recoup budgeted profits or losses so as to achieve a net return of zero in the accumulated operating results account. The principle objective of these stabilized rates, and a major advantage to customers, is consistency and protection from wide variances in budgeted costs due to inflation, fuel prices, utility prices, etc. Rates thus established for the NIF activity are expected to remain in effect for the entire fiscal year.

Stabilized rates have been in effect for all NIF activities since FY77, and the stabilized rates are different for each NIF activity. The NIF activity commander develops the budget based on a specific level of rate stabilization. Then the final rate for each individual NIF activity is modified by the NIF Activity Group Commander, NAVCOMPT, and the Office of the Secretary of Defense (OSD).

This control over rates consequently affects the revenues of the activity, and expenditures on capital investments. The Capital Investment Program has provided activities with greater flexibility in acquiring essential resources in order for them to remain competitive with the private sector. However, complete activity autonomy and maximum productivity enhancement has not been realized due to the centralized control in rate stabilization [Ref. 7:p. H-21]. Indeed, there are hierarchical limitations imposed in the acquisition of capital investments and productivity improvements.

C. PWC OPERATIONS

The trend of Navy shore activities to consolidate and relocate into major naval complexes has resulted in the consolidation of many public works departments. This provides for central management of PWCs while still maintaining independent operations. The consolidation has enabled effective management by recognizing commonalities and significant savings as a result of economies of scale. NAVFACENGCOM realized that limited maintenance resources could best be utilized by PWCs if there was a standard organization, procedure and modern systems operation that applied to all centers. This standard PWC organization was introduced in 1965.

In an effort to improve public works services to the Navy and other military commands, and to consolidate like functions in San Francisco, the Chief of Naval Operations (CNO) directed the Chief of Naval Material (NAVMAT) Command to establish a new Navy Public Works Center in the Bay area in July, 1974. The Center services a number of activities including: Naval Station, Treasure Island; Naval Supply Center, Oakland; Naval Air Station, Alameda; Naval Hospital, Oakland; and the U.S. Army Base, Oakland. The inclusion of an Army activity marked the first PWC consolidation that consisted of other than Navy shore activities. Interestingly enough, the consolidation effort was the result of a report made to the Secretary of Defense by the Real Property Maintenance Consolidation Committee, chaired by the Army [Ref. 8:p. 23].

At present there are nine PWCs. Eight operate under the NIF, and one, in Yokosuka, Japan, is funded by appropriations. The others are located in Norfolk, Virginia; Pensacola, Florida; Great Lakes, Illinois; San Diego and San Francisco, California; and Subic Bay in the Philippines. Each is an independent naval command providing a full range of public works services (i.e., utilities, maintenance, construction, engineering, housing, transportation, and planning). This support is provided to operating forces and shore activities within the local area served by the PWC. In 1980 the PWCs were providing public works services to over 2,000 customer commands, of which 183 were receiving services in excess of $150,000 annually [Ref. 9:p. 15]. PWC San Francisco alone was responsible for 228 customer agencies with $72 million in total costs incurred for customers [Ref. 10:p. 7.8]. The volume of business has since increased to over $117 million in FY84. Total personnel on board averages 1,460. The estimated volume of business for all PWCs in recent years has been well over a half billion dollars. This represents the work effort of about 11,000 civilian personnel, or 60 percent of the total NAVFAC employees, supplemented with private contracts of approximately 40 percent [Ref. 11:p. 21]. NIF PWCs provide one-third of all Navy public works services. The eight NIF PWCs operate with a permanent capitalization corpus of $15.6 million [Ref. 9:p. 18].

To further assist the PWCs, a centrally designed and maintained computerized information system called the PWC

Management System (PWCMS) was implemented in 1968 [Ref. 11:p. 21]. PWCMS is an information system which provides planning services, controlled maintenance inspection services, and preparation of annual inspection summaries. The system attempts to utilize many of the key measurement indicators used in today's business world such as net present value, and return on investment. Since February 1977, a new system called PWC Automated Data System (ADS) has been under development to extend the capabilities of PWCMS. ADS will attempt to modernize the 12-year old PWCMS program by adding mainframe computers to process PWC operational requirements.

In 1969, a PWC corporate management program was initiated with the intent that PWCs would operate as divisions of a single organization. By the early 1970s, commanding officers of PWCs were becoming increasingly concerned about the demand from customers for higher responsiveness and lower service costs. This need for a more effective and efficient system for PWC work management was addressed by the Assistant Commander for Operations and Maintenance. His response was a proposal called the Production Management System (PMS) which would manage work from the initial request to physical completion and billing [Ref. 11:p. 21].

In 1975, a pilot system was implemented at PWC San Diego. This was designated as PMS Phase II, and incorporated modern production management concepts and techniques. PMS Phase I was simultaneously implemented at the other PWCs with the

objective of immediately improving management of emergency, minor, specific, and recurring work. The transition to PMS Phase II for the other PWCs was expected to be more gradual in eliminating the multiple system organization. The existing PWC structure separated responsibility for the work into two categories--planning and operations. The planning officer was responsible for completion of the job plan, and the operations officer saw to the material procurement and work accomplishment. The PMS Phase II organization was designed to provide clear functional responsibility and control for all work through a single group--production. The efficiency and effectiveness in managing PWC work has been strengthened under PMS. The total system approach has organized the work flow, mechanized procedures, and integrated operations, ultimately decreasing labor costs and enhancing productivity.

IV. NAVFACENGCOM PRODUCTIVITY IMPROVEMENT PLAN

A. INTRODUCTION

Fundamental to NAVFACENGCOM's Productivity Enhancement Program is the annual development of a Productivity Improvement Plan. This plan receives input from NAVFAC Headquarters and field activity organizations by way of productivity target issues. These productivity target issues cover a broad range of subjects including productivity measurements, capital investments, and human resource development. Each of these areas forms an integral part in the formulation of the Productivity Improvement Plan. Also included in the plan are criteria for measuring activity performance and milestones for management action. The Plan's overall objective is to provide a structured approach to improving performance in an activity's assigned function, and to create a positive emphasis on productivity improvements at all levels of an organization [Ref. 12:p. 3].

B. PRODUCTIVITY MEASUREMENTS

The plan calls for establishing and implementing a measurement system to assess current performance, and to monitor future productivity initiatives. NAVFACENGCOM has chosen a productivity ratio to statistically measure organizational productivity and progress from year-to-year. This productivity ratio is a comparison between an activity's

direct labor man-hours versus indirect man-hours (overhead) plus direct labor man-hours less overtime. The productivity ratio goal presently set for Public Works Centers by NAVFAC-ENGCOM is 73 percent (i.e., for every 100 activity man-hours, 73 are identified as direct labor)[Ref. 13]. In addition to monitoring the productivity ratio, PWC San Francisco has 24 other indicators which measure production management and productivity , 21 indicators measure material efficiency, and eight indicators measure resource utilization [Ref. 14].

C. CAPITAL INVESTMENTS

Capital investment is also considered an integral part of the Productivity Improvement Plan, where demonstrated technologies and improvements can result in identifiable cost savings to the activity. The Asset Capitalization Program (ACP), in conjunction with the Productivity Enhancing Capital Investment (PECI) program, was intended to provide PWCs with the means for financing such productivity enhancing technologies [Ref. 2:p. 22]. While the ACP (as a DOD Industrial Fund program) is somewhat general in the application of allocated funds, the PECI program consists of a number of independent funds which address specific investment opportunities. However, in PWCs' modernization efforts, the PECI program has received less attention than ACP. [Ref. 15]

There are several PECI programs which may be used for enhancing productivity through capital investment. One such program is the Fast Payback Productivity Enhancing

Incentive Fund (PEIF), whereby projects are funded through the Office of the Secretary of Defense (OSD). These projects must have a cost of less than $100,000, and a payback of less than two years. Navy Industrial Fund (NIF) activities are precluded from participation in this category [Ref. 1:encl 1, p. 1].

Productivity Investment Fund (PIF) projects are also sponsored by OSD. The projects are selected from throughout the DOD and compete for funds which have been set aside specifically for PIF. The minimum project investment for NIF activities is $300,000, and it must have a payback of four years or less [Ref. 1:encl. 1, p. 1].

The Navy-sponsored Productivity Investments in Cost of Ownership Reduction Investment (COORI), also referred to as Component Sponsored Investment (CSI), projects are investments in facilities and equipment which improve the operational capabilities of the fleet, and reduce the cost of ownership of materials used. COORI projects are competitively selected from throughout the Navy. There are no specific funding limitations; however, for practical reasons, the minimum investment is $3,000 [Ref. 1:encl. 1, p. 1]. These projects must also be amortized within five years of installation completion [Ref. 1:encl. 1, p. 1]. The fund was previously sponsored by Naval Material Command (NAVMAT), and was intended to supplement funding of Navy productivity projects beyond the dollar limitations of OSD-sponsored

programs. However, NAVFACENGCOM has received no guidance concerning the status of this fund since the disestablishment of NAVMAT. NAVFACENGCOM has also stated that this program has never been used by any PWC. The reason for this is that headquarters views this program as being reserved more for production-oriented activities such as shipyards. NAVFACENGCOM considers PWCs as service-oriented rather than production-oriented. [Ref. 15]

The final category under PECI is the Industrial Funded Fast Payback (IFFP) program. This program is no longer of concern since it was eliminated from NIF activities on September 30, 1982 [Ref. 16].

According to the Command Productivity Principal at PWC San Francisco, the ACP has received more attention from PWCs than has the PECI program [Ref. 17]. The program permits managers of NIF activities to purchase equipment or make repairs without going through the planning, programming, and budgeting process. DOD's direction states that all industrial equipment for NIF activities will be acquired with NIF revenues rather than with appropriated funds [Ref. 18]. NIF activities are still eligible for PIF participation, but only under the following special conditions: (1) prototype or multifunction/multiservice projects, (2) installed and collateral equipment associated with military construction (MILCON), (3) equipment to meet mobilization requirements where no peacetime application exists, (4) equipment normally

provided as government-furnished equipment (GFE), (5) test range equipment, and (6) equipment for tenant activities at NIF installations [Ref. 18]. According to NAVFACENGCOM, PWCs have not submitted a PIF project since FY82. The perception at NAVFAC headquarters is that the PIF program, like the COORI program, is reserved for those activities on the leading edge of technology (research and development), or production-oriented activities. [Ref. 15]

In addition to NAVFACENGCOM's view that PWCs do not fall within the purview of the PIF, there is also criticism of the PIF concerning extensive reporting procedures, and long lead times from project submission to equipment acquisition [Ref. 15]. OSD's annual submission request for PIF projects is for program year proposals (current FY + 2). OSD says this long lead time is necessary to review and prioritize all project submissions [Ref. 19]. They also state that such decisions have to be accomplished before the development of the annual budget decision [Ref. 19]. It is for these reasons that, since the inception of the ACP in FY83, PWCs have relied extensively on the Capital Equipment Investment Program for productivity improvements and modernization rather than the PIF [Ref. 19]. The Command Productivity Principal at PWC San Francisco does admit that the PIF program may be used as a potential adjunct to the ACP if projects can be identified which comply with the technical and funding guidelines of PIF, and which can be "relegated to the uncertainties of

the appropriations cycle [Ref. 20]." The ASD/A&L has thus tried to encourage the use of PIF by maintaining an open data call in order to receive project entries throughout the year. Those projects not resolved for entry into the program competition for the current year will automatically be considered for the following year. Previously, activities were required to submit, in writing, a request for a rejected project to be reconsidered in a subsequent year [Ref. 1:encl. 3, p. 2].

OSD recommends that all commands exercise year-round consideration and screening of proposals. Other suggestions put forth in an effort to improve the quality and viability of the PIF projects include clear accountability for fund management and documentation of resulting savings. OSD considers this documentation as essential in establishing credibility for the PIF program [Ref. 19].

Another key factor which is emphasized is feedback to project originators. A criticism previously expressed by activities was that they had not been informed of service or OSD actions, or funding decisions [Ref. 19]. Consequently, activities were discouraged from proposing investment projects in succeeding years. Thus, OSD also encourages activities to establish advance proposal screening and evaluation boards in an effort to reduce unnecessary costs for project documentation, and to provide economic analysis for marginal projects. Finally, DOD directives state that if PIF investment returns are to be maximized, it is important that an

awareness of successful applications be promoted and exchanged between services and agencies [Ref. 19:encl. 2].

OSD's decision in FY83 to capitalize equipment at industrial fund activities resulted in the exclusion of about one-half of the PIF project submissions for that year [Ref. 19]. An ASD/A&L memorandum emphasized that excluded NIF projects would have priority during the next fiscal year. The statement went on to say that NIF activities would still be eligible for the PIF programs under the special conditions previously outlined [Ref. 19]. NAVFACENGCOM has responded by encouraging PWCs to take advantage of PIF by submitting project requests for equipment associated with MILCON. To date, no PWC has availed itself of this program. In fact, there were key personnel at PWC San Francisco who were not even aware of this opportunity [Ref. 21].

D. HUMAN RESOURCE DEVELOPMENT

The final element of the Productivity Improvement Plan addresses human resource development and utilization. The program involves training and retraining programs to meet changing job requirements, as well as specific education programs directed at improving employee-management cooperation. The intent of such efforts is to ultimately improve productivity, product quality, and quality of working life by improving employee talents and effectiveness. Human resource development is best established through a structured performance-reward system. [Ref. 12:encl. 2, p. 1] The

system is designed to offer increased challenges to employees, eliminate unproductive actions, and offer a sense of competition and cooperation in the work force [Ref. 12:p. 3]. Human resource development is another topic beyond the scope of this thesis.

E. ACTIVITY INPUT IN THE NAVFACENGCOM PRODUCTIVITY IMPROVEMENT PLAN

At present, there is no NAVFACENGCOM instruction which directs PWCs to develop an activity Productivity Improvement Plan [Ref. 15]. However, in FY84 NAVFACENGCOM's Command Management Plan (CMP) listed as a corporate goal those initiatives which would, in NAVFAC's view, produce a PWC recipient of the Chief of Naval Material Productivity Excellence Award [Ref. 15]. In response to this corporate goal, PWCs were directed to submit to NAVFACENGCOM a Productivity Improvement Plan [Ref. 15]. The activity plan represented productivity issues solicited from all departments in the organization. The foreword to PWC San Francisco's plan stated that the effort generated considerable internal interest, particularly in the area of documenting productivity initiatives. PWC San Francisco found that personnel wanted recognition for the efforts they put forth in addressing such issues. The foreword further stated that the preparation of the plan resulted in an increased awareness of the importance of productivity and enhanced the momentum toward more creative solutions to productivity problems. The process was described

by PWC San Francisco's Executive Officer as iterative with departmental productivity issues being documented in a specific format. The subsequent communication between the Command Productivity Principal and department heads resulted in restructuring certain initiatives and/or expanding into new areas. [Ref. 22]

Each department outlined productivity initiatives which required management attention in either their department, or at the organizational level. The final plan listed all initiatives by department. The format included a description of the initiative or problem with no specific economic or engineering analysis. The information was based almost exclusively on the department head's experience or first-hand knowledge of the situation. A short paragraph followed each initiative which offered a subjective assessment of derived benefits should the initiative be resolved. The final paragraph for each initiative was a proposed schedule addressing a solution. Unfortunately, departments made no attempt to identify and schedule the necessary milestones for resolution of the problem. [Ref. 22]

PWC San Francisco's Executive Officer considered the issues presented in the plan as preliminary. It was stated in the Productivity Improvement Plan that the initiatives were expected to mature through further study and investigation. This would, in the opinion of PWC San Francisco's Executive Officer, lead to documentation and support for expeditious resolution of the problem. [Ref. 22] The FY84

PWC Productivity Improvement Plan was to be updated annually, and was viewed as a central source of information on evolving productivity issues available to all levels of the organization. However, NAVFACENGCOM's CMP corporate goals for FY85 do not include continuation of the activity Productivity Improvement Plan [Ref. 15].

PWC San Francisco's planning in productivity has been limited to the submission of productivity target issues for possible inclusion in NAVFACENGCOM's Productivity Improvement Plan [Ref. 17]. As stated previously, productivity target issues of concern to NAVFAC headquarters and field activities are submitted for review by the NAVFACENGCOM Productivity Steering Committee which selects relevant target issues to be included as a part of the command's annual Productivity Improvement Plan.

The specific format for submission of target issues contains seven different elements. The title is a short phrase which identifies the area of productivity concern. The problem section is a statement as to the difficulty or problem which prompted the submission of the potential target issue. The discussion section provides a background statement to aid in understanding the problem and possible benefits are listed should the problem be resolved. The issue objective is a more specific statement of the productivity problem which identifies areas to be examined or further developed. The coordination section identifies the organization or

individuals who may provide input or have a vested interest in the issue as determined by the originator of the activity's submittal. The applicability section names those activities which may benefit from a resolution of the problem. Again determination is based upon the originator's judgment. The last section lists the originator, both the command activity and an individual point of contact, for the purpose of followup. [Ref. 23:encl. 4]

A call for productivity target issues is promulgated by NAVFACENGCOM in the latter part of each fiscal year. All responses from field activities must be received by September 1 for inclusion in the following year's plan. Those target issues which can be resolved at the activity level are specifically excluded from submission to NAVFACENGCOM. Acceptable issues must be of concern or interest to one or more NAVFAC organizations. [Ref. 24]

The number of submissions varies from year to year. In FY84, PWC San Francisco was successful in having one of its target issues approved for inclusion in the NAVFACENGCOM Productivity Improvement Plan. The issue dealt with modernization of time and labor accounting procedures [Ref. 25]. Yet, in FY83, PWC San Francisco submitted no target issues [Ref. 26]. Due to the interest expressed by the commanding officers of all PWCs, a NAVFAC-approved target issue addressed the difficulties activities were having in programming replacements for civil engineer support equipment (CESE).

The solution identified by NAVFAC was that the NIF Capital Equipment Investment Program (under the ACP) was to commence in FY83, and would resolve the issue [Ref. 24:encl. 1].

NAVFAC assures all activities that feedback will be provided on every target issue submitted regardless of whether it is accepted or rejected [Ref. 6]. NAVFACENGCOM further assures that all approved target issues will be properly planned for in the investment program or human resource development plan, whichever is applicable [Ref. 6:p. 2]. Problems arise with the program because the NAVFACENGCOM Productivity Steering Committee eliminates approximately half of the submissions by saying they do not fall within the criteria specified for productivity target issues. A majority of these are referred back to the originator stating that local action is sufficient to resolve the issue. Another one-third of the submissions are issues which have been previously addressed, and for which NAVFAC says there is no immediate solution (e.g., salary increases to retain proficient engineers and technicians). Thus, NAVFACENGCOM actually considers only about one-sixth of all submissions.

F. COMMAND PRODUCTIVITY PRINCIPAL

The PWC Productivity Principal is instrumental in formulating the activity's productivity target issues for submission to NAVFACENGCOM. The Productivity Principal at PWC San Francisco stated that it is important that the individual designated have visibility within the command,

be knowledgeable of all command productivity actions, and act as coordinator in planning and implementing such actions [Ref. 17]. The duties and responsibilities for which this individual is assigned are similar to those of NAVFACENGCOM's Productivity Principal. These duties include advocating productivity within the command, acting as a point of contact for productivity resource planning, ensuring that productivity measurements are compatible with productivity iniatives, and coordinating the development of plans and strategies in an effort to maximize productivity enhancement [Ref. 12:encl. 3].

Specifically, the Command Productivity Principal at PWC San Francisco plays a major role in determining the evaluation criteria to be used in capital equipment acquisitions and their assigned priorities [Ref. 17]. An effort has been made to rely on the Productivity Principal to assist division and department heads in compiling their respective capital equipment investment lists [Ref. 17]. Furthermore, as a collateral duty at PWC San Francisco, this position has increased responsibilities to include the ACP [Ref. 17]. In this regard, the Productivity Principal is required to prepare all documentation and justification in the submission of the command's Five-Year Capital Equipment Investment Plan for all non-civil engineering support equipment (CESE) capital acquisitions. In the opinion of the current Productivity Principal, this increased involvement in the ACP

and accompanying wide-ranging command responsibilities has decreased the time spent on economic and analytical review of legitimate productivity improvements [Ref. 17]. To the Productivity Principal, the time expended seems narrowly focused on capital equipment investments rather than on an overall productivity plan [Ref. 17].

V. ASSET CAPITALIZATION PROGRAM

A. INTRODUCTION

The Public Works Center emphasis on modernization can be described as an interdependent program combining the internal resources of the activity and allocated appropriations. To facilitate the most efficient use of resources, there are five individual programs which are aimed at achieving improved productivity and modernization. The first three, minor construction, management information systems, and capital equipment, are part of a larger program known as the Asset Capitalization Program (ACP) which are discussed in this chapter. The other two, military construction and major maintenance, repair, and alteration investment, while contributing to modernization, are not part of the ACP, and are not discussed here.

On 19 August 1981, the Deputy Secretary of Defense issued a memorandum which stated that the DOD's intent was to increase efficiency and enhance productivity at industrial fund activities by expanding the authority of local commands allowing them to purchase certain assets [Ref. 27:p. 4]. Specifically, the new policy approved the financing of capital equipment, management information systems, and minor construction for industrial fund activities with industrial fund resources rather than the use of appropriated funds [Ref. 28:p. 1]. Subsequently on 14 January 1982, the

ASD/COMPT issued detailed financial management, budgeting, and accounting information with regard to implementation of the program. The new policy would become effective at all Navy Industrial Fund activities upon congressional approval of the FY83 Department of the Navy budget [Ref. 28:p. 2].

DOD-budgeted resources for this program were initially deleted at the start of FY83 because of a House of Representatives Appropriation Committee report which stated that the DOD had not prepared a "sufficient foundation" for launching such a major initiative in that fiscal year [Ref. 29]. The report was issued in November 1982, subsequent to the program's implementation in October 1982. The minor construction and management information systems portions of the program were not affected, but the portion affecting capital equipment required modification until the ACP could be fully implemented. In the interim, activities were permitted to use the Fast Payback Capital Equipment Investment Program.

Full implementation of the ACP actually took place in FY84. The program now allows industrial fund activities to use their operating budgets for modernization efforts and productivity enhancement. The basic premise of the program is that the cost of acquiring certain assets can be charged to the industrial fund cost of operations, and recovered through stablized rates used to bill customers. The program offers NIF activities great flexibility in improving operational efficiency through the acquisition of modern equipment and the upgrading of essential facilities [Ref. 17].

B. MANAGEMENT INFORMATION SYSTEMS

The acquisition of and accounting for management information systems (MIS) is subdivided according to hardware and software assets. The separation is due primarily to different life expectancies and user specifications. Whereas industrial fund activities have been directed to account for MIS hardware as a capital investment which is to be depreciated, MIS software possesses three different characteristics which activities can use in identifying it as an asset: long life, significant cost, and legal identity.

The Comptroller of the Navy (NAVCOMPT) has determined that software which exceeds $100,000 in cost, and has a useful life of more than two years, will be capitalized and depreciated [Ref. 28:encl. 1, p. 3]. The costs of a management information system under development are also considered. All costs associated with the development are accumulated in an asset under development general ledger account. When the system becomes operational, the costs are removed from this account and capitalized. [Ref. 28:encl. 3, p. 4]

A software asset which does not exceed $100,000 in cost, or does not have a useful life of more than two years, is expensed [Ref. 28:encl. 1, p. 3]. NAVCOMPT has also made provisions for large software expenses which may distort operating results. Activities are permitted to account for the software expense as a deferred charge which may be amortized over an unspecified period of time to minimize the

distortion in any one fiscal year, or amortization may take place over the useful life of the software--which ever occurs first [Ref. 28:encl. 1, p. 3].

Recently, NAVFACENGCOM introduced mandatory implementation of two different management information systems. First, the automated data system (ADS) will be required to be operational at all PWCs by the end of FY85 [Ref. 13]. Second, computer aided design (CAD), and computer aided manufacturing (CAM) systems, were put in place at PWCs Norfolk, San Diego, San Francisco and Pearl Harbor by the end of FY84, with other PWCs being scheduled to receive them in subsequent fiscal years. NAVFACENGCOM required both ADS and CAD/CAM to be a part of the activity's Five-Year Capital Equipment Investment Purchase Plan [Ref. 13] which is discussed in a following section. The annual budget call requires this Five-Year Capital Equipment Investment Plan, together with separate justification for all MIS items [Ref. 28:encl. 2, p. 3].

C. MINOR CONSTRUCTION

Minor construction projects which cost less than $100,000 and are of direct benefit to the industrial fund activity (not tenant activities) are also financed from industrial fund revenues, capitalized, and depreciated [Ref. 28:encl. 1, p. 3]. In addition to minor construction projects for tenant activities, there are other minor construction projects which are excluded from industrial fund financing. They include projects to meet mobilization requirements when

no (or limited peacetime) application exists, and projects for major range and test facilities. All minor construction projects at PWCs are a part of the Five-Year NIF Special Projects Program. NAVFACENGCOM permits commanding officers to approve projects costing up to $75,000 [Ref. 13]. Projects with a cost of between $75,001 and $200,000 must be approved by NAVFAC (code 152) [Ref. 13].

Minor construction also includes all real property maintenance, repair, and alteration (MR&A) projects which benefit the industrial fund activity. These costs are charged to the cost of operations, and recovered through stabilized rates. This MR&A category differs from the major MR&A investment previously mentioned. The latter are projects costing over $100,000, and must be financed from authority in the military construction appropriation. Also excluded from real property MR&A projects is damage of over $100,000 caused by catastrophe or acts of God. These projects are funded from appropriated funds made specifically available for this purpose. [Ref. 28:encl. 1, p. 4]

D. CAPITAL EQUIPMENT INVESTMENTS

Capital equipment is defined as having an acquisition cost of $1,000 or more, and a useful life of more than two years [Ref. 28:encl. 1, p. 1]. This equipment which includes shop equipment, automated data processing equipment, administrative equipment, civil engineering support equipment (CESE), and material handling equipment (MHE), must be capitalized

and depreciated [Ref. 30]. The acquisition cost includes all costs necessary to place the item in use such as freight charges, testing, and installation costs [Ref. 28:encl. 1, p. 2].

In preparation for the implementation of the ACP, all capital equipment in the custody of industrial fund activities was recorded in the industrial fund general ledger accounts on October 1, 1980, at net book value. PWC San Francisco had approximately 3,500 such equipment items, and estimated the contract costs of such an assessment at $62,000 [Ref. 17: appendix B]. Then, commencing on 1 October 1982, the depreciation on all new capital equipment, and that equipment recorded at book value, was charged to the cost of operations and recovered through inclusion of the depreciation costs in stabilized rates for which customers are billed.

The billing is based on three factors: (1) projected costs, including the depreciation mentioned on all capital equipment; (2) accumulated operating results (AOR)(gain or loss) from prior year operations which are distributed to customers by way of a payback factor; and (3) budgeted adjustments to assure sufficient cash to meet operational requirements (including the acquisition of items such as capital investments) [Ref. 28:encl. 2, p. 5]. The AOR which is recognized and distributed to customers is the AOR for the activity group level (all PWCs), and not just the activity. DOD customers also are not normally required to

make cash payments in advance of work actually performed by the industrial fund activity. An exception is Naval Shipyards which accepts payment for long lead-time material involving significant dollar amounts.

Depreciation is computed using the acquisition cost less residual value over the estimated useful life of the asset (straight line method). Assets are not permitted to be fully depreciated while still in use. When changes occur in the useful life of the asset, the remaining value of the asset, based on the fair market value, is depreciated over the revised remaining useful life. The depreciation once computed can then be charged either as a direct charge, or as a production or general and administrative overhead expense [Ref. 28:encl. 3, p. 4]. If the depreciation can be identified with a specific project or customer order, then it is considered a direct charge. In all other cases, the depreciation is an expense, and is included in the applicable cost center's production overhead or the activity's general and administrative overhead rate. The depreciation can only be recorded at the industrial fund activity at which the equipment is actually being used [Ref. 28:encl. 2, p. 2]. Capital equipment for tenant activities is excluded from the NIF activity's ACP. However, capital equipment can be procured by the activity in conjunction with tenant-requested work. This means capital equipment procured for tenant activities is not capitalized or depreciated by the industrial fund activity [Ref. 28:encl. 2, p. 2].

Other exclusions from the program include equipment funded by the military construction appropriation (installed equipment), a weapon system, purchase of aircraft or ships, and equipment provided as government-furnished equipment (GFE). Passenger vehicles are specially provided for with Other Procurement Navy (OPN) funds, and are also excluded. Capital equipment which is not covered by the ACP, construction and alteration projects costing over $100,000, repairs costing over $100,000 for damage caused by catastrophe or acts of God, and compensation for military personnel are also excluded from the program, and are provided for by other appropriated funds [Ref. 28:encl. 2, p. 6]. Cash supplements which are added to the activity's corpus for pay raises, increased stock fund costs, and increased inflation are recognized as revenues for the activity, but are not available for equipment acquisition and cost recovery from customers [Ref. 28: encl. 2, p. 5].

Equipment with an acquisition cost of less than $1,000 or a useful life of less than two years is expensed, and is not considered capital equipment [Ref. 28:encl. 2, p. 1]. As with management information systems, large equipment expenses which may distort operating results can be amortized over an unspecified period of time to minimize this distortion. However, any maintenance, repair, or alteration of capital equipment which has a cost of $1,000 or more, and results in the useful life of the equipment being extended by more than

two years, must be capitalized and depreciated. All equipment procured under the ACP must be accounted for in the industrial fund activity's Five-Year Capital Equipment Investment Plan. [Ref. 28]

E. FIVE-YEAR CAPITAL EQUIPMENT INVESTMENT PLAN

NAVFACENGCOM, as the PWC activity group manager, is required to develop a Capital Equipment Budget (CEB) which accompanies the annual submission of the A-11 budget for all PWCs [Ref. 28:encl. 2, p. 1]. The CEB is used to outline a proposed equipment acquisition and funding plan for the budget year, and is derived from the first year of the Five-Year Capital Equipment Investment Plan. The CEB is made up of two basic elements: target obligations, and target expenses (outlays). The target obligations are taken directly from the activity group Five-Year Capital Equipment Investment Plan. Target expenses, on the other hand, are dependent upon cash flow which is determined by future depreciation costs and the computation of stabilized rates.

The primary objective of the PWC Five-Year Capital Equipment Investment Plan is to provide a cost effective means to acquire and maintain capital equipment necessary for the performance of the PWC's mission. The plan specifically allows for the timely identification of capital equipment requirements, organized time-phasing of capital equipment procurements, and identification of productivity enhancing equipment for future acquisition. A key element of the plan is a

productivity strategy which provides a framework for integrating capital investments with mission planning and departmental goals. [Ref. 30:p. 2]

Historically, at PWC San Francisco, effort or resources had not been devoted toward the planning and implementation procedures for equipment acquisitions. Equipment requirements that were identified in the production shops were requisitioned with a material requisition/issue document (MRI), and submitted to the Naval Supply Center at Oakland, California for purchase. Responsibility for supporting documentation such as equipment specifications, sole source justification, and prioritization of equipment needs was delegated to the production manager. The system of direct purchase by production shops was satisfactory for minor equipment and consumables, but inappropriate for activity modernization involving major acquisitions of capital equipment [Ref. 27:p. 7]. This led PWC San Francisco to the realization that an effective modernization effort could not be conducted using a process whereby equipment requirements were independently generated by a variety of concerned parties without management oversight [Ref. 27:p. 7].

The Five-Year Capital Equipment Investment Plan was designed to address such issues, and to provide the centralized coordination necessary to achieve the primary goal of recapitalization--productivity enhancement through capital equipment modernization [Ref. 27:p. 7]. PWC San Francisco then recognized that major changes were needed to implement

such a program. For one, the equipment acquisition function could no longer be considered as merely the replacement of aged equipment. Second, it was clear that additional manpower had to be allocated to the equipment planning function. This was due to the fact that more information would be needed to support equipment requests under this program than had been required in the past. The additional information would be the result of engineering investigations, record-keeping and accounting, and economic analyses. A key individual to the whole implementation effort was the project leader, who also served as the command point of contact for the Capital Investment Program and Productivity Principal. PWC San Francisco's Command Productivity Principal estimated that the necessary manpower, both for internal and contracted services, would cost $591,000 at implementation [Ref. 27:p. 22].

The ultimate approach adopted at PWC San Francisco required accomplishment of three major tasks: (1) defining a command capital investment strategy, (2) developing a capital investment opportunities matrix, and (3) organizing an equipment planning data base [Ref. 27:p. 8]. The command capital investment strategy included generalized objectives concerning enhancing efficiency and productivity through the orderly exchange of capital for labor, improving the quality of working life for all PWC employees, and improving response time to customer requests for service by reducing production impediments. The implementation of this strategy called for a two-phased approach [Ref. 27:p. 10).

Phase 1 was intended to improve communications and the transfer of information between activity and customers, and between personnel within the activity [Ref. 27:p. 10]. The enhanced communication and data handling would effectively improve response time and productivity through more efficient documentation preparation, revision, and transmittal. Phase 1 also included refining and expanding the replacement-oriented equipment program with emphasis on economic analyses and use of technological advances in equipment [Ref. 27:p. 11].

Phase 2 was an extension of Phase 1. Under Phase 2, a procedure was developed for prioritizing, scheduling, and implementing both replacement and new equipment acquisitions. A set of evaluation criteria is applied to items requested. The score achieved by each request rated against the evaluation criteria would establish the rank order under which procurements would be undertaken. Further discussion on the subject of economic analysis and evaluation criteria for ranking for equipment acquisitions are provided in the next chapter.

The second major task which required attention was the development of a capital investment opportunities matrix. The purpose of this matrix is to provide a logical procedure for identifying, prioritizing, and scheduling individual investment opportunities [Ref. 27:p. 12]. The format is to document the many factors which enter into equipment acquisitions. The final presentation of all significant factors

affecting investments such as need, feasibility, and urgency would readily discern the most favorable opportunity. PWC San Francisco's Command Productivity Principal ultimately hopes to convert the matrix form into a programmed routine which will enable the rapid and accurate generation of investment priorities and implementation schedule [Ref. 17:p. 13]. A fundamental characteristic of the matrix system, which would be enhanced by a computer, is the flexibility one has in assessing the effect of different economic analyses and policy changes on investment rankings and scheduling [Ref. 27:p. 13].

The third major task which had to be addressed initially was the establishment of an equipment planning base. The consolidated information would be considered essential in the equipment planning process, and form the basis for the capital equipment investment strategy and capital equipment opportunities matrix. Major information elements that were required included the cost of operations for specific functions and the cost of similar operations performed internally. Information needed from the private sector included the costs associated with the operation and maintenance of individual pieces of equipment, and the applicability of any current technologies to PWC operations. The sources for such data came from published information, private sector seminars and trade shows, and most importantly, contracted studies. Once these three major tasks had been accomplished, the details

for compiling and submitting the major document in the Capital Investment Program could be specified.

All industrial fund PWCs are required to submit to NAVFACENGCOM (Code 152), a Five-Year Capital Equipment investment Plan [Ref. 30:p. 2]. The plan is due by March 1 of each year, and includes the present year, current year, budget year, budget year+1, and budget year+2 [Ref. 28:p. 2]. The basic format of the plan has two main categories: replacement of existing equipment, and acquisition of new capability. Each of these categories is subdivided into five specific types of capital equipment: industrial plant equipment (IPE)/shop equipment, automated data processing (ADP) equipment, administrative equipment, MHE, and CESE. Each of these subdivisions is further broken down according to obligated and expended funds for each of the five fiscal years.

The new capability category is defined as equipment necessary to support a newly assigned mission, task, or function. The PWC must forward a letter fully documenting the request, and outlining the additional responsibilities imposed on the activity. NAVFACENGCOM notes that an increase in a machine's capability due to technological advances is not a new capability. Once received by NAVFAC headquarters, each PWC's plan is reviewed and consolidated into the NIF A-11 budget. [Ref. 30:p. 2]

Annually, NAVFACENGCOM provides each PWC with an obligational authority based upon the PWC's submission in the Capital Equipment Investment Plan. In effect, this limits the amount of PWC Navy Industrial Fund (NIF) capital funds that can be spent on capital equipment acquisitions. NAVFACENGCOM plans call for PWCs to expend two percent of their total annual revenues on capital equipment in FY83, and five percent in FY84 and FY85 [Ref. 27:p. 4]. In FY85, NAVFACENGCOM provided PWC San Francisco with an obligational investment allocation of $7,237,685 [Ref. 31:encl. 1]. Management information systems were excluded from this target, but the FY85 authorized target did include $57,685 as a carryover from FY83 [Ref. 31:encl. 1]. Activity groups which fail to budget funds properly for productivity enhancing investments are faced with billing customers higher annual charges due to operational inefficiencies and increased labor costs. The resulting increase in operating costs becomes evident to resource managers at higher levels who expect efficiency improvements from modernization efforts.

The ACP has given PWCs considerable leverage in modernizing their CESE and MHE. NAVFACENGCOM has encouraged all PWCs to budget approximately 80 percent of their capital equipment budgets for replacement or upgrading of their MHE and CESE allowances. [Ref. 15] PWC San Francisco allocated $5,936,610, or 82 percent of their total FY85 investment allocation for this purpose [Ref. 31:encl. 1]. CESE is

centrally procured, and requirements from all PWCs are forwarded to the Civil Engineer Support Office (CESO) in Port Hueneme, California. The remaining amount was used for shop equipment, ADP equipment, and administrative equipment including furniture. This remainder also included $94,469 as a contingency to be used to cover cost overruns and other emergent requirements which may occur during the year [Ref. 32:encl. 1]. However, the PWC stressed that eventually all authority would be used. The intent was to use all of the authority, while staying within the authority granted. In FY85, 12 of PWC San Francisco's 20 cost centers submitted capital equipment budgets and received obligational authority [Ref. 31:encl. 1]. For FY86, PWC San Francisco's five percent of total revenue investment target allocation amounted to approximately $9,106,000 [Ref. 33]. The activity's CEB requested $10,382,000, of which $5,683,000 was earmarked for CESE/MHE [Ref. 33]. The decrease in budget request for CESE and MHE may be attributed to the substantial amounts obligated in previous fiscal years, and the PWC's overall equipment fleet modernization [Ref. 17].

In conjunction with the Capital Equipment Funding Plan, a Summary of Capital Assets-Related Depreciation Schedule is submitted each fiscal year as part of the Five-Year Capital Equipment Investment Plan. There are five main categories with each category having dollar values for capital equipment, management information systems, and total amounts for both. The first category is the total acquisition value,

or gross book value, of the capital equipment or management information system. This total is derived by the addition of three components: equipment on hand as of the beginning of the year, equipment estimated to be delivered during the applicable fiscal year, and a negative amount for the acquisition value of items to be disposed of during the fiscal year. The FY86 schedule for PWC San Francisco shows a total acquisition value for capital equipment of $26,554,000, and management information systems of $2,729,000 [Ref. 34:encl. 2, p. 1].

The second category shows both the average aggregated useful life of equipment on hand as of the beginning of the fiscal year (less any retirements), and the estimated useful life of the equipment expected to be delivered during the applicable fiscal year. Again for FY86, the schedule shows 8.6 years and 10.4 years respectively for capital equipment at PWC San Francisco [Ref. 34:encl. 2, p. 1].

The third category depicts the total annual depreciation expense for all equipment held by the PWC. Broken out of this total and shown separately is the depreciation associated with new deliveries. The total estimated annual depreciation for capital equipment in FY86 was $2,167,000 [Ref. 34:encl. 2, p. 1].

The fourth category shows the total amount of depreciation expenses on all equipment from the initial purchase until the end of the applicable fiscal year. Also shown

separately under this category is the accumulated depreciation associated with the equipment retired during the fiscal year. The total accumulated depreciation for capital equipment at PWC San Francisco in FY86 was estimated to be $5,508,000.

The final category shows the net book value of all equipment in the custody of PWC San Francisco, and is derived by subtracting the total accumulated depreciation (category four) from the total acquisition value (category one). The net book value of all capital equipment held by PWC San Francisco was estimated to be $21,046,000 in FY86 (Ref. 34: encl. 4, p. 1].

All PWC NIF capital equipments have different thresholds for approval authority and procurement justification. The justification, when required, includes a narrative description and an economic analysis. NAVFACENGCOM requires all such justifications be submitted with annual submission of the activity's Five-Year Capital Equipment Investment Plan. Equipment with a unit acquisition cost of less than $15,000 can be approved by the activity commanding officer, and requires no economic analysis or post audit reports. For equipment costing between $15,000 and $100,000, the approval authority is still at the local level, but an economic analysis is required. Between $100,000 and $1 million, the acquisition must be approved by NAVFACENGCOM, and be accompanied by an economic analysis. All procurements of

$1 million and above must be approved by NAVFACENGCOM and NAVCOMPT and include an economic analysis. The last three categories also require the maintenance of post audit records. These records are kept for the life of the piece of equipment. In carrying out the procurement of capital equipment, PWCs are still required to comply with all congressional, DOD, and NAVFACENGCOM regulations concerning the management and approval for the purchase of equipment such as ADP equipment, CESE, and office equipment. [Ref. 30:encl. 3]

A planning calendar developed at PWC San Francisco is used to ensure the timely submission of the Five-Year Capital Investment Plan by March 1. The schedule promulgated calls for data requests to begin the fiscal year prior to the plan's initiating fiscal year. It is outlined as follows:

> October 9: The comptroller department issues a memorandum requesting all departments to compile a proposed capital equipment buy list.
>
> October 15: The comptroller department forwards a memorandum to the management department requesting a computerized printout listing all capital equipment in the custody of the PWC. This listing shows the estimated life, accumulated depreciation, net book value and asset value for each piece of equipment.
>
> October 29: All departments are to forward their proposed capital equipment buy lists to the comptroller department.
>
> October 31: The management department provides the comptroller department with the ADP capital equipment listing.
>
> November 5: The comptroller department forwards the ADP listing which is formatted by cost center to all departments. Cost center managers are directed to annotate the listing showing the retirement of any assigned capital equipment.

November 27: All cost center managers are to return the ADP listing with annotations to the comptroller department.

November 29: The transportation department prioritizes all CESE and MHE on the department buy lists. The management department prioritizes all non-CESE capital equipment on the buy lists. Both departments then prepare presentation packages for review by the Capital Equipment Board.

December 3: The transportation and management departments present the activity's proposed capital equipment buy list to the Capital Equipment Board. The board members are the activity's executive officer, production officer, planning officer, senior activity civil engineer, comptroller, management department head, production group superintendent, and the project leader for the capital equipment program--who is also the command productivity principal.

March 1: The comptroller department prepares the necessary documents supporting the five-year capital equipment investment plan and forwards this to NAVFACENGCOM. [Ref. 35]

May: NAVFACENGCOM reviews and consolidates the five-year capital equipment investment plans for all PWCs.

June: The composite plan is put in the A-11 budget for NAVCOMPT review.

August: OSD reviews A-11 budget submissions.

September: Congress passes the new fiscal year DOD budget.

October: Funds are allocated to major claimants who in turn allocate to NAVFAC and then to field activities. [Ref. 13]

The total capital acquisition process is an iterative one with the first four years of each five-year plan being updated annually, and the fifth year prepared completely.

VI. ECONOMIC ANALYSIS

A. PRIORITIZING CAPITAL EQUIPMENT REQUESTS

The Capital Equipment Investment Plan requires that all industrial plant equipment (IPE), shop equipment, administrative equipment, and automated data processing (ADP) equipment (excluding civil engineering support equipment (CESE) and material handling equipment (MHE) which are submitted as part of the plan) be prioritized [Ref. 36]. The Naval Facilities Engineering Command (NAVFACENGCOM) has provided no specific guidance with respect to a comprehensive ranking system [Ref. 17]. It is an individual command responsibility to devise the procedures which equitably allocate capital funds. Regardless of the method adopted, all activities apply some sort of evaluation criteria to each equipment request in order to establish a rank ordered listing. [Ref. 30:p. 2] At PWC San Francisco, the production department is responsible for applying the evaluation criteria to individually rank ordered lists provided by each department. The production department is in a key position to consider command priorities, and therefore has the authority to cut across departmental lines in an effort to assess accurately the legitimate activity needs and urgencies [Ref. 36]. PWC San Francisco has developed seven primary ranking elements with additional subfactors in several of these. The seven elements are:

- Departmental Ranking
- Project Need
- Rate of Return (ROR)
- Effect on Scarce Resources
- Effect on Commercial Activity (CA)
- Competitiveness
- Effect on Quality of Working Life [Ref. 37].

Each of the ranking elements is applied using a weighted scoring method. The weight factors which are assigned to each ranking element are a subjective notion whose values may vary from year to year, and from management to management. PWC San Francisco's Command Productivity Principal offered no information as to the rationale used in making these assignments other than the fact that emphasis was often at the discretion of the commanding officer [Ref. 17]. The activity's senior management would take into consideration NAVFAC priorities, but the final weighted values would be decided at the activity level. PWC San Francisco's Command Productivity Principal also noted that changes in the command investment strategy (previously discussed) could easily be accommodated by the manipulation of the weight factors assigned to each element.

Scores for all ranking elements, subfactors, and weights are assigned a value ranging from one to ten. The weighted score is then calculated by multiplying the score for a particular element or subfactor by its assigned weight. The

total score for each capital equipment request is then equal to the sum of all the weighted scores for each element or subfactor. The total scores for each request are then ordered from the highest value to the lowest. Using the scores as a ranking, those equipment items selected for investment are chosen from this list until allocated funds are exhausted. A brief description of each ranking element and the scoring methodology is now offered.

- Element I. Departmental Ranking

This is a simple element with no subfactors. A score is assigned based on the relative priority assigned to each request by the submitting department. The score is calculated by applying the following formula: Score=[(N+1)-P](10/N), where N is the total number of requests submitted by the department, and P is the priority number assigned by the department [Ref. 37].

- Element II. Project Need

This element is made up of three subfactors, each established to determine the relative need for the investment item. The three subfactors are mission essential, needed replacement, and enabling project [Ref. 37]. The mission essential category describes the degree to which the requested item is needed to meet PWC mission requirements. If the item is requested because of higher authority or local command direction, a maximum score of ten is assigned to this subfactor [Ref. 37]. The needed replacement category is determined

based on the function fulfilled by the capital equipment item. If the item requested is needed to replace a vital piece of equipment for which there is no alternative substitute, a maximum score of ten is assigned [Ref. 37]. A lesser score is assigned if the need to replace the item is reduced by the availability of alternate equipment. A lesser score is also considered if the existing item has low usage. The third subfactor, enabling project, has a scoring criterion which is based on the degree to which the requested item can be determined to contribute to future beneficial activity, procedural changes, or further modernization [Ref. 37]. The subfactor is best described as any equipment that is needed to make future improvements possible. An example of this is equipment which automates a variety of functions such as word processing equipment, microcomputers, and automated storage and retrieval equipment. The scores in each of one of these subfactor categories is based primarily on information provided by the originating department on an equipment requirement worksheet which must be submitted for all equipment requests.

- Element III. Rate of Return (ROR)

The discussion concerning the economic analysis procedures for capital investments arose when the Industrial Fund Fast Payback Program was discontinued on 30 September 1982. Prior to this, the Fast Payback Program had used the payback period procedure as the method of analysis. A new method of analysis

had not been specified under the Asset Capitalization Program (ACP) which was to take effect on 1 October 1982. To address this problem, the commanding officer of PWC Pensacola, Florida, advocated in a letter to NAVFACENGCOM that the ROR method be adopted as the primary analysis procedure. The letter was accompanied by arguments that the payback period has long been recognized by engineering economists as an invalid procedure when used as the primary method for screening proposed investments. [Ref. 38] The letter went on to quote a text which objected to the payback period because the method made no allowances for cash flows after the payout date. A NAVCOMPT instruction also noted that it was possible to have several investments with the same payback period, but with different rates of return [Ref. 1:encl. 2, p. 5]. The final point made with respect to the payback period method was that it did not measure the profitability of a proposed investment. Its usefulness was only in the measurement of how long the invested capital would be unavailable for other uses. Support for the ROR method came from the same NAVCOMPT instruction mentioned earlier which stated that the ROR is the single most important economic measure. It includes in one factor the combined effects of payback period and return on investment, and at the same time is independent of the size of total investment savings.

In September 1982, NAVFACENGCOM forwarded a letter to NAVCOMPT via the Chief of Naval Material recommending the

adoption of the internal rate of return (IRR) or rate of return (ROR) as the primary analysis procedure for determining capital investments at NIF activities [Ref. 39]. The Naval Material Command (NAVMAT) responded by agreeing that the use of ROR was an acceptable analytical procedure in determining capital equipment acquisitions [Ref. 40]. However, the reply further stated that among the various NIF activity groups there were instances where the ROR method should not necessarily be the primary analytical procedure. NAVMAT concluded that NAVFAC could use ROR as the primary analysis procedure for determining capital equipment investments at PWCs [Ref. 40]. NAVFACENGCOM forwarded the response to all PWCs for information purposes, but did not make the use of ROR mandatory.

The ROR is considered an economic factor, and is used to compare the relative economic benefits of investments. By definition, ROR is the discount rate that equates the present value of future cash flows resulting from the investment to the initial equipment cost. In using this ranking element, the ROR is first calculated, and then a score is determined by the simple application of the following formula: Score=ROR(%)/20. The maximum score of ten therefore equals an estimated ROR of 200 percent. ROR is the current procedure used at PWC San Francisco.

- Element IV. Effect on Scarce Resources

This element is also made up of three subfactors which represent exhaustible items, or items in short supply.

The scores for each are assigned according to the degree the equipment request conserves the following resources: energy, critical materials, and manpower [Ref. 1:encl. 2, p. 6]. The reduction in energy and the usage of critical materials saves funding resources and allows the activity to direct the dollars to more critical areas. Therefore, the greater the reduction, the higher the assigned score. The reduction of critical employee skills on a given job also promotes employee mobility and efficiency, and increases the flexibility of the work force. Likewise, the greater the reduction in these critical skills, the higher the score.

- Element V. Effect on Productivity Ratio

This is a simple element with no subfactors. A score is assigned according to the degree to which the request is determined to reduce the relative requirement for overhead functions.

- Element VI. Effect on Commercial Activity Competitiveness

No subfactors are included in this element. The Office of Management and Budget Circular A-76, as revised in 1983, requires that government "commercial activities" compete with the private sector for the right to carry out those functions. According to A-76 rules, each military service must periodically review base operation support activities to determine if commercial contractors could accomplish them more economically. If a private firm's bid is at least 20 percent less than the in-house bid of the activity, contracting out is

mandatory [Ref. 41:p. 3]. Obviously, there is great pressure on activities to be more cost effective. The score for this element is therefore based on the degree to which the requested item is determined to improve the competitive status of PWC San Francisco in commercial activities studies undertaken.

- Element VII. Effect on Quality of Working Life

There are three subfactors included in this element: health and safety, job enrichment, and work environment. High scores are given to any change in job environment that reduces health and safety hazards, or reduces boredom and increases initiative or motivation. Also, any change in the working surroundings that makes the job more pleasant or flexible is given high marks. All scores are based on the degree to which the item requested is determined to enhance quality of working life. [Ref. 37]

B. SCHEDULE FOR DEVELOPMENT OF REQUIREMENTS LIST.

The capital equipment buy lists which ultimately become part of the Five-Year Capital Equipment Investment Plan originate at the division level. The process begins when the executive officer issues the equipment requirement worksheets and provides a general overview statement. The equipment requirement worksheet contains the basic data input for evaluating the request. The information contained on this worksheet includes the assigned priority by the department, unit cost of the item, installation cost, total cost, a brief description of the item, and its estimated useful life.

If the item is a replacement, the originator must provide information on the item to be replaced such as the year it will be disposed, the original acquisition cost, and the accumulated depreciation. If the item has a total cost exceeding $15,000, there is also an economic analysis and justification section which must be completed for NAVFAC purposes.

Concurrent with the issuance of the capital equipment worksheet, the production department along with the Command Productivity Principal develops the weight factors for each of the ranking elements. This information is issued to all department heads. Once the divisions have prepared the worksheets (they are given approximately one month), they are submitted to the department heads. The department heads are responsible for screening the worksheets, prioritizing, and forwarding the authorized list to the production department. The production department and Command Productivity Principal then apply the evaluation criteria and generate a command prioritized listing of requirements. This list is forwarded to the comptroller department in order for them to assess the impact of the new acquisitions on the projected stabilized rates. This financial assessment is provided to the production department which develops the finalized list of requirements based on the comptroller input. The commanding officer and executive officer then review and approve the acquisition plan which becomes part of the Five-Year Capital

Equipment Investment Plan. This process is used only for capital equipment other than CESE and MHE. The transportation department head has sole responsibility for developing the CESE/MHE buy list which is not prioritized, and is only limited by the recommended 80 percent of the activity's assigned NAVFACENGCOM target amount for capital equipment [Ref. 17].

C. NAVFACENGCOM ECONOMIC ANALYSIS

As previously mentioned, NAVFACENGCOM requires an economic analysis and justification for all equipment with a total cost exceeding $15,000. The format is a single-page data-sheet. The form, once completed and signed, represents a proposal to spend public funds. There are seven sections which require completion:

- Section 1. A full description of the piece of equipment being purchased must be provided.
- Section 2. The activity is required to describe the objectives of the proposal, any alternate methods considered, and the consequence of disapproval. This section further requests the activity to describe any equipment to be replaced, repair costs during the last three years if known, and recommended disposition of the aged item.
- Section 3. The estimated net one-time costs associated with the procurement must be calculated. It is determined by summing the total purchase price of the acquisition, the cost of removing the old equipment, and the undepreciated book

value of the old equipment. The estimated disposition value of the piece of equipment to be replaced is then subtracted from this total to derive the net one-time costs.

- Section 4. The estimated annual cost of the acquisition is calculated by dividing the estimated net one-time cost by the estimated useful life in years.

- Section 5. The activity is required to estimate the annual cost of leasing the proposed equipment.

- Section 6. The economic analysis consists of listing all costs and savings associated with the utilization of the requested item. Each cost associated with personnel compensation, labor acceleration, rents, communications and utilities, supplies and materials, depreciation and maintenance and repair costs is entered into one of three subcategories: A cost increase, a cost benefit which results in the reduction of an existing cost, or a cost avoidance of a currently non-existing but expected future cost. Each of these cost subtotals represents an adjustment to the annual operating costs expected from the procurement.

- Section 7. The net increase or decrease in annual operating costs is calculated by subtracting the sum of the cost reduction and cost avoidance subtotals from the cost increase subtotal. [Ref. 30:encl. 4]

NAVFACENGCOM's Productivity Principal states that the requirement for an economic analysis is supported by the possibility of an audit [Ref. 15]. The documentation on file is sufficient, in their view, to justify capital equipment

investments made by field activities. As admitted by NAVFACENGCOM, and evidenced by the justification form, the analysis and subsequent review are only cursory.

D. IMPLEMENTATION AT THE ACTIVITY LEVEL

PWC San Francisco has developed a capital equipment ranking system which, in the opinion of the Command Productivity Principal, equitably distributes available funds [Ref. 17]. However, there are internal weaknesses which hamper the functioning of the program. The Capital Equipment Investment Plan is a new method of operation for PWCs, and as of yet personnel are still unfamiliar with both the intent and procedure of the program. The Command Productivity Principal is the key individual in guiding the Capital Equipment Investment process. The Command and individual departments consistently rely upon the person in this position when preparing and submitting the plan. In fact, as the annual submission date approaches, the Command Productivity Principal assists all departments at the department level in compiling equipment requests and applying the Command's evaluation criteria. The time available to this one person is insufficient for completely satisfying the needs of all departments. Consequently, not all equipment requests are thoroughly analyzed or justified. [Re. 17]

The difficulty in establishing the equipment request lists is further compounded by the lack of knowledge of technological developments in equipment, and ignorance of market

availability. Equipment requests are based upon the knowledge of the personnel of the department, and this may or may not be adequate in selecting the best as far as cost and performance are concerned. The Command Productivity Principal states that a lack of funds to send personnel to trade shows and seminars, and to provide technical literature limits the knowledge base from which equipment requests are initially developed. The point was also made that it is unreasonable to expect personnel to remain current on technological advances while at the same time requiring them to accomplish an ever-increasing work load. Unfortunately then, knowledge is narrowly based on personal experience. [Ref. 17]

One weakness which has been alleviated to some extent by the Command Productivity Principal's participation in the Capital Equipment Investment Plan is the application of evaluation criteria. There has been difficulty in consistently applying the criteria from department to department. A majority of the ranking elements which must be scored are subjective in nature. Department heads rank their equipment based upon what they consider appropriate priorities. The problem is that each department may view the Command priorities and departmental requirements differently. The Command Productivity Principal's involvement has provided a broad perspective on activity needs, and has helped to balance any perceived inequalities. [Ref. 17]

One other weak point is the economic analysis required by NAVFACENGCOM. Due to time constraints and deficient analytical skills, departments put forth minimum effort in this area. The pressure to complete the submission results in best-guess decisions which are not technically substantiated. [Ref. 17] Supporting documentation which would require a detailed analysis of calculations and assumptions would enhance the benefit of the single-page data-sheet presently used.

One can conclude that the overall functioning of the Capital Equipment Investment Plan at PWC San Francisco results in a prioritized command equipment list from which acquisitions are made. However, several of the internal weaknesses mentioned raise doubt as to the validity of this list. Certainly the activity is acquiring equipment which is needed. The main question is: Is the most essential and efficient piece of equipment available for a designated function?

VII. CONCLUSION

A. INTRODUCTION

There is a consensus among management personnel at PWC San Francisco that the ACP--specifically, the Capital Equipment Investment Program--has made a substantial contribution to the modernization and revitalization of capital assets at the PWC. The Five-Year Capital Equipment Investment Plan has provided the PWC with the opportunity for long-range planning, and has given the PWC more control over, and flexibility in making changes at the activity level. This control of the programming, budgeting, operating and measurement, and reporting and analysis functions may account for the enthusiasm with which the program has been embraced. These interrelated phases of a management control system provide the basis for some conclusions.

B. PROGRAMMING

The programming phase involves the process of selecting specific programs for organization action. Those programs which are selected are activities which the organization undertakes in order to implement its strategic plan. The process of programming involves three related but separate activities. The first activity is the preparation and analysis of proposals for new programs. The second is the analysis of ongoing programs. The third is a system for

coordinating the separate programs so as to maximize their effect upon the activity. [Ref. 42:p. 394] The productivity programming for NAVFACENGCOM is incorporated in its Productivity Improvement Plan [Ref. 30:p. 2]. No such plan exists at the activity level, however [Ref. 17].

One approach to enhancing productivity at PWCs would be to require the development of a command Productivity Improvement Plan. Although not presently required, such a plan would offer an overall strategy for identifying and implementing productivity initiatives within the activity, and it also would serve as a working document for program implementation. Since the commanding officer is the guiding force in translating strategic planning into program decisions, a key factor in the success of such a program would be the commanding officer's priority assigned to productivity and the consideration it is given with respect to the large number of potential allocations of resources. Quite simply, a viable program will result only if productivity enhancement becomes a significant command priority from the top down.

The command Productivity Improvement Plan should consider individual productivity-related initiatives, schedules for implementation, financial implications, and follow-on reviews which measure performance against corporate goals and objectives. A general plan will not guarantee productivity success at all PWCs, however. The plan must be specifically formulated at each activity, incorporating all available local

resources in order to develop a comprehensive approach to enhancing productivity.

To satisfy the analysis function for programming, PWC San Francisco has endorsed the procedure for establishing the activity's own capital equipment evaluation criteria and prioritization methods. This procedure also makes it possible for unplanned circumstances and unique investment opportunities to be quickly incorporated in the annual Capital Equipment Budget (CEB). Internal productivity initiatives, then, are being satisfied by the ACP and industrial fund activities have found little need for productivity-enhancing investment programs sponsored by OSD and SECNAV such as Productivity Enhancing Investment Fund (PEIF), Productivity Investment Fund (PIF), and Cost of Ownership Reduction Investment (COORI).

C. BUDGETING

The budgeting phase is an organization's plan of action expressed in monetary terms. Those productivity programs which are adopted become the responsibility of assigned divisions and departments which have been allocated funds for their execution. PWC San Francisco uses the budget as a management plan, and capital investments, as a part of the activity budget, are planned for and controlled internally by the organization [Ref. 43]. NAVFACENGCOM does provide oversight however, and maintains overall budgetary control of capital investments.

Even though PWC capital investments are limited to the target amount approved by NAVFACENGCOM, the PWC San Francisco budget officer states that complete obligation of this amount is sometimes difficult to achieve [Ref. 43]. Thus, the capital investment funding limitation does not appear to be a constraint in improving productivity at PWC San Francisco. The other Productivity Enhancing Capital Investment programs appear unnecessary for productivity enhancement at PWC San Francisco.

Although the consolidated command buy list at PWC San Francisco often exceeds the five percent of activity revenues recommended by NAVFACENGCOM, all legitimate capital equipment requests for capital equipment purchases are forwarded. Capital equipment buy lists submitted by department heads are based exclusively on need, and not on funds available. The subsequent obligation of funds may reduce the original buy list somewhat due to the fact that some requests may come to be considered invalid or no longer of interest. More protection against unrestricted buying comes through the prioritization of capital equipment (except for civil engineering support equipment), which limits the purchase of nonessential items to some degree. Nonessential items are given low priority, and are much less likely to be funded. However, it should be noted that, in general, the more revenue collected by the industrial fund activity, the larger the target amount approved for capital investment, and the greater the number of acquisitions.

D. OPERATING AND MEASUREMENT

The third phase of a management control process requires the collection of data on the actual results of program operation so that they can be compared with the plan set forth in the budget. The measurement method is important because it directs the actions taken by personnel. Those factors which are measured receive management attention and emphasis to the possible detriment of other relevant elements. Productivity measurement is one area which requires review at both the NAVFACENGCOM and activity level.

NAVFACENGCOM established a productivity ratio to measure labor productivity--specifically direct labor. This productivity ratio is a comparison between an activity's direct labor man-hours versus indirect man-hours (overhead) plus direct labor man-hours less overtime. However, this method of measurement creates a disincentive in the purchase of productivity enhancing capital equipment. It reduces or eliminates personnel, thereby lowering the activity's measured ratio. The PWCs provide a service, and emphasis should be placed on measuring that service. What should be measured (and often is) is the level of service, quality, timeliness, and customer satisfaction. This approach allows for the acquisition of capital equipment, reorganization of shops/departments, or the restructuring of shop layouts, which contributes to productivity without specific attention being focused on direct labor. The PWC goal of enhancing services

provided to customer activities must be central to any productivity measurement.

Included in the third phase of the management control process are the operating characteristics of the activity. The Commercial Activity (CA) program has had an impact upon PWC operations seeking modernization and revitalization. The competition between private sector contractors and PWC activities for the right to carry out functions has placed pressure on the government activities to be more cost efficient. To remain competitive, NAVFACENGCOM policy requires field activities to organize CA functions within their command into the most efficient and cost effective organization (MEO) [Ref. 44]. For those functions ultimately retained in-house by the activity, there have been real cost savings associated with productivity improvements. A logical recommendation would be to extend the MEO concept to other functions within the organization. The same rigorous review of work methods, cost allocations, and personnel assignments required for CA functions would be applied to all services and capabilities provided by the activity. All MEOs would be regularly reviewed by the parent organization to ensure efficiencies and cost effectiveness are maintained. The MEO, coupled with the Capital Equipment Investment program, provides a foundation for productivity enhancement and capital equipment modernization that is germane to a particular activity. The PECI Program, on the other hand, is

more general in application and offers far less flexibility in its functioning. Thus, industrial fund activities, like PWCs, are more inclined to utilize a program such as the ACP which can be internally directed and controlled.

E. REPORTING AND ANALYSIS

An activity's management control system serves as a communication device. The information that is communicated consists of reports and analyses within the organization. The information is intended to keep managers informed of organizational performance and variances between actual and planned programs which may require action. As the fourth phase of the management control process, reporting and analysis is the final link which allows management to alter future programming, budgeting, and operations.

Fundamental to the continued success of the ACP, therefore, is the perceived need for a review of the acquisition's acceptability. Does the capital equipment investment provide the necessary capability to match the required task? Is it the most efficient and economical investment available? Is it state-of-the-art equipment? Does it require retraining of personnel, reorganization of shops, or maintenance support? There are just a few of the questions which must be addressed in determining what specific equipment will ultimately be included on departmental buy lists.

Shop supervisors and first-level managers are expected to make such decisions. Their personal experience is often

the only tool currently available to them. What is needed is a more systematic and technical approach which calls on the expertise of industrial engineers, personnel managers, and financial analysts. With such a technical approach, the final buy lists should contain the most economical and efficient capital equipment for the investment.

The command's responsibility should address the overall integration of all capital investments. The following questions should be asked: Does the investment impact upon other departments? Can certain investments be consolidated? What are the overall effects on the organization and staffing? At present, capital investments are examined individually and evaluated based upon their own merits or rejected based upon isolated disadvantages. The integrated approach to capital equipment acquisition would support the activity's strategic planning and take advantage of the existing equipment data base.

A logical extension of the capital equipment integration plan would be a post economic analysis on a project evaluation. The requirement for such an analysis already exists in the OSD and SECNAV PECI programs, but not in the ACP. Such an analysis would help guide managers in making future investments and evaluating past decisions. One recommendation would be for the analysis to be only used internally, and to be structured to meet the specific needs of the activity.

F. INFORMAL VERSUS FORMAL CONTROL SYSTEMS

The informal control systems, sometimes reflected in unwritten organizational policies, are referred to as the organization's control environment or its culture. They include processes for motivating personnel to take desired actions. Organizational productivity may be derived from a myriad of sources, both formal and informal, and encompass all functions within the activity; therefore, it requires full participation of its members. Encouraging and recognizing this participation should be promoted if the full potential of productivity improvement is to be realized.

Capital equipment investment should be considered as just one element in initiating and implementing productivity improvements. Each department and, if feasible, each shop should contribute any and all initiatives identified within their respective areas of responsibility. It is imperative that all initiatives be documented. This should include quantifying recognized savings and, more importantly, providing awards for individuals who have contributed to enhancing productivity. Such an award program may also be expanded to include shops, departments, and support and support and administrative personnel. In all cases, the award must be tangible, desired, publicized, and consistent. Furthermore, with the disestablishment of Naval Material Command and the Chief of Naval Material Productivity Excellence Award, it is recommended that NAVFACENGCOM institute

a Chief of Civil Engineer's Productivity Excellence Award for PWCs. Only with continued emphasis and motivated management established through a well-outlined plan will productivity awareness become a part of the organization's culture. It is this organizational culture which will encourage innovation and sustain productivity enhancement.

Productivity improvement requires the simultaneous integration of formal and informal control systems. The result may require the activity to alter substantially normal business procedures. A radical course of action would be an organizational change. This means identifying areas where the number of employees could be reduced or functions combined. The first target would be supervisors who incur the largest excessive costs. The effort should be directed toward effective placement of these personnel, and utilization of existing facilities. Consolidation of certain functions should be considered since this reduces the number of supervisors and increases control. The efficient use of supervisors should include hands-on management, particularly in the areas of quality control and work scheduling. The line supervisors would then have a greater span of control over their work force, and play a larger role in assuring the quality of their product.

Similarly, the work force itself should be multi-skilled. The informal flexibility this offers would allow supervisors to place personnel where needed in peak demand situations.

Although industrial fund activities cannot lower wages or indiscriminately hire and fire personnel, there remains the ability to lower the average pay grade of workers in certain functions. The assignment of qualified but lower-graded workers is cost effective and sound management.

Both formal and informal controls instituted should allow for ongoing reviews of assigned work. If productivity gains are to be made, all work must be based on a specified budget and follow a carefully defined set of guidelines. However, tasks which are in direct support of the customer should receive top priority. Staff personnel must then maintain a service orientation while performing other assigned administrative duties.

Finally, underlying all control processes is the idea of directing a variable, or set of variables, to a goal or objective. In an organization, people are the variables to be directed, guided, or motivated to pursue goals. There must be a definite commitment from workers and management to establish productivity goals and accountability. A well-planned and sound productivity program does not necessarily ensure its use. Productivity is more fundamental than spending money to save money. Even with no apparent barriers, such programs often fail because there are internal dysfunctions or a lack of organizational attitudes which support productivity. Therefore, those goals set by the activity must encourage individual contributions to the overall work effort for any productivity enhancement program to succeed.

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